Coastal Engineering Technical Note

Title: INTERPRETING HISTORIC DREDGING DATA AND BATHYMETRIC SURVEYS TO SUPPORT RECOMMENDATIONS FOR ALTERING DREDGING

Purpose:

A major concern at many tidal inlets around the United States is how to reduce maintenance dredging costs. This CETN uses East Pass, Florida, as an example of how historic dredging data and bathymetric surveys can be used to evaluate whether dredging can be reduced. The particular alternatives reviewed are realigning the navigation channel or reducing its dimensions.

Introduction:

Dredging is performed at many tidal inlets around the United States to provide for safe navigation from the open sea to, usually, a harbor or waterway in the backbay area. Dredging is expensive, and a major goal of much ongoing research is to determine ways of reducing the cost of maintaining safe navigation channels through tidal inlets. The purpose of this CETN is to show how historic data can be evaluated to provide guidance on whether changes in navigation channel alignment or dimensions can reduce the amount of material needing to be dredged.

The examples used in this report come from East Pass, Florida (Figure 1). This is the only tidal inlet between Choctawhatchee Bay and the Gulf of Mexico and is located along the Florida Panhandle between Pensacola and Panama City. Although this is a relatively low energy shoreline, the behavior and morphology of the inlet and the ebb- and flood-tide shoals resemble that of inlets found along the much higher energy Atlantic coastline.

The first stage of the evaluation is to obtain historic records of the volumes of material removed each time the inlet was dredged. For Federally maintained projects, such data are available from the Annual Reports of the Chief of Engineers on Civil Works Activities. Unfortunately, the summaries sometimes include a combined volumetric total from several areas within an overall project. Consequently, data from a particular channel may not be listed separately. Different names may have been used over the years to refer to the same site, and project dimensions may have changed. Although the U.S. Army Engineer Districts keep excellent records, it may be difficult to obtain detailed data for particular channels, especially for work done more than two or three decades ago. If possible, the bathymetric surveys made before and after dredging should be used to calculate the volumes.

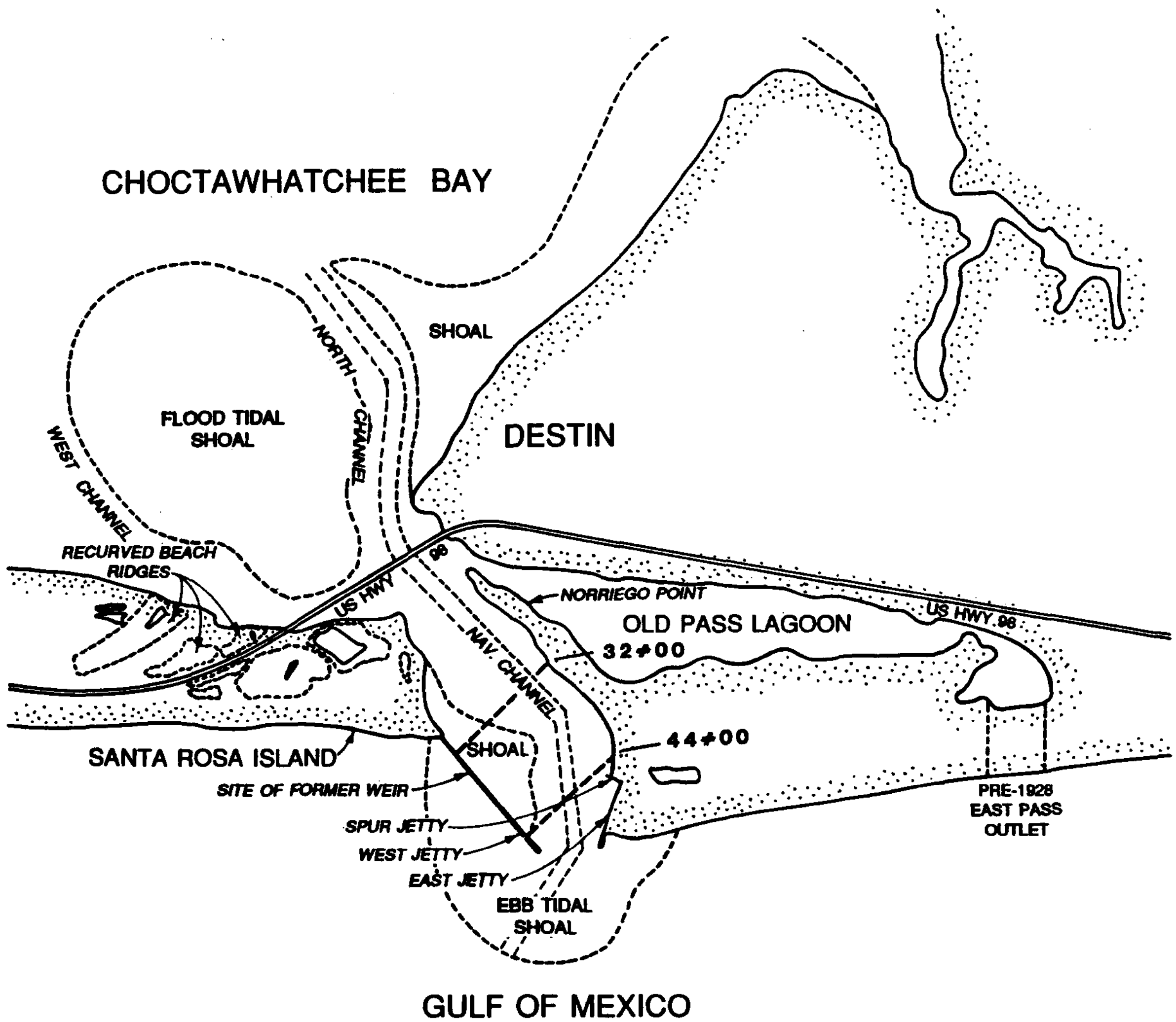

Figure 1. East Pass, Florida

Review of historic data:

Figure 2 shows the cumulative amount of sand dredged at East Pass plotted against time. The curve includes both the main East Pass channel from the Gulf of Mexico to Choctawhatchee Bay and the Old Pass channel, which leads from the main channel into Destin's harbor. From 1931 to 1951, about 17,000 cu yd/yr of sand was dredged to maintain a 6x100 ft channel. From 1951 to 1988, to maintain a 12x180 ft channel, the dredging rate increased significantly to 97,000 cu yd/yr. This increased rate is shown by the steepening of the curve starting in 1951. Rubble-mound jetties were built at East Pass in 1967 and 1968 to help stabilize the inlet and reduce shoaling. During the 20 years following construction, however, the overall slope of the curve did not change, which indicates that the dredging rate remained nearly constant. A dip in the curve in 1968 probably reflects inaccuracies in reporting from where sand was removed. As part of the project, a deposition basin near the west jetty was dredged. It is likely that the East Pass channel was also

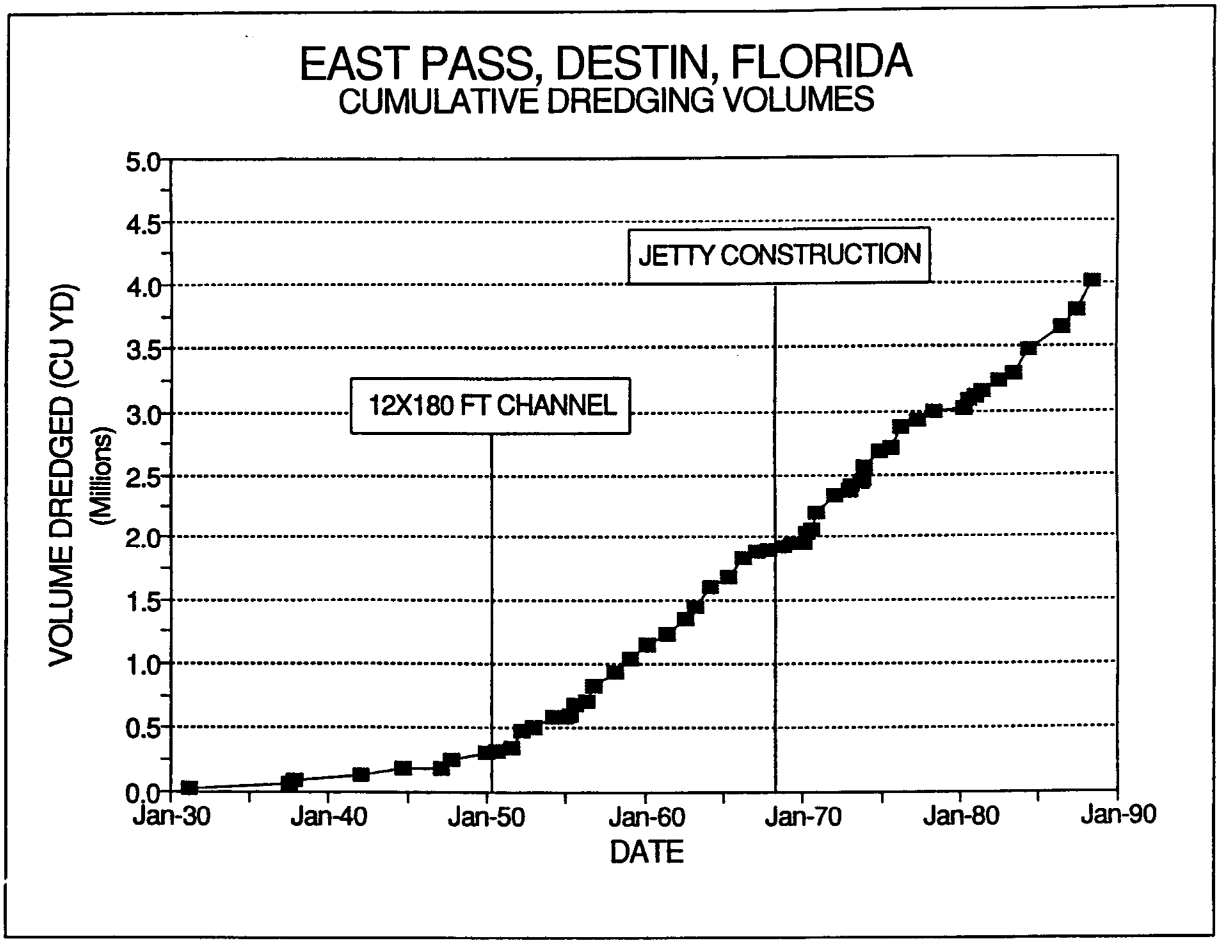

Figure 2. Cumulative dredging volumes from East Pass and Old Pass channels

dredged at this time, and the dredge volume from the channel included in the volume listed for the deposition basin.

Information on sedimentation patterns and the effect of dredging are revealed by plotting profiles across the inlet. Figure 3 shows profiles at Station 32+00. The February and June curves show the inlet before and immediately after dredging. Within the navigation channel, 40 percent of the sand has returned by September, and the bottom has shoaled from -15 ft MLW to about -13 ft. Note that the natural channel along the east shore remains at a near constant depth of over 15 ft. The east shore is steeper in June and September because dredged sand was placed along the beach, which had suffered serious erosion. The profiles at Station 44+00 (Figure 4) display a similar pattern (within three months after dredging, 33 percent of the sand has returned to the navigation channel).

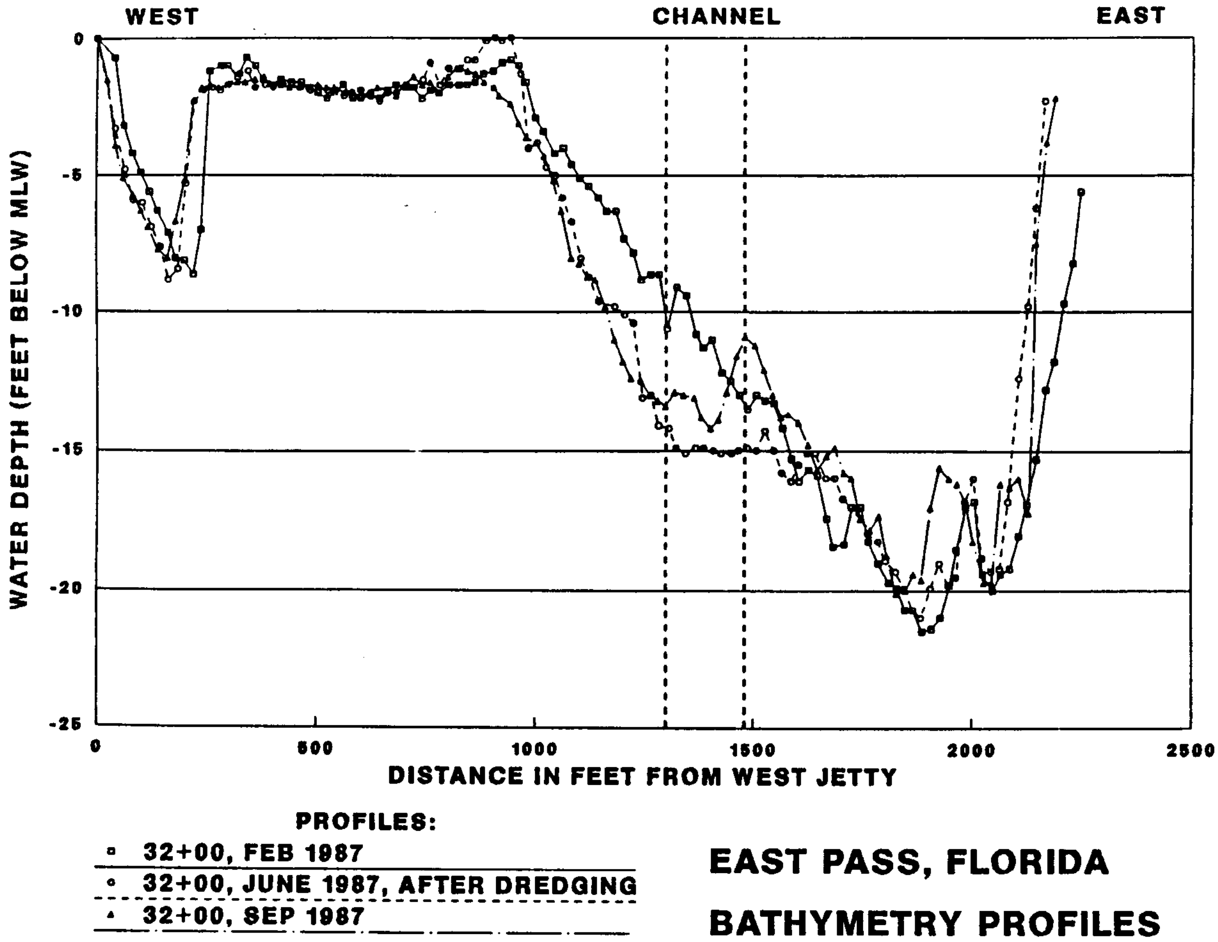

Figure 3. Profiles along line 32+00

Discussion:

The superimposed profiles suggest that the navigation channel in East Pass, which follows the center of the inlet and shoals rapidly after dredging, could be relocated to follow the natural thalweg. Economic and practical factors such as the locations of the bridge spans, the cost of moving navigation markers, and the alignment of the proposed channel, would have to be carefully studied. Objections might be raised that if the channel followed the thalweg, boat wakes would aggravate erosion along the east shore. Although some effect from boat wakes is possible, the profiles show that natural processes have directed the main flow of water along the east side of the inlet, resulting in steep sides and an ongoing erosion problem. In addition, it is likely that local fishermen and boaters already use the natural channel since they are doubtlessly aware that the official navigation channel is often shallower than the authorized 12 ft.

The reduction in dredging to be expected by relocating the channel to follow the thalweg will probably be significant for the zone within the inlet proper. It would be unlikely to achieve a similar improvement over the unprotected

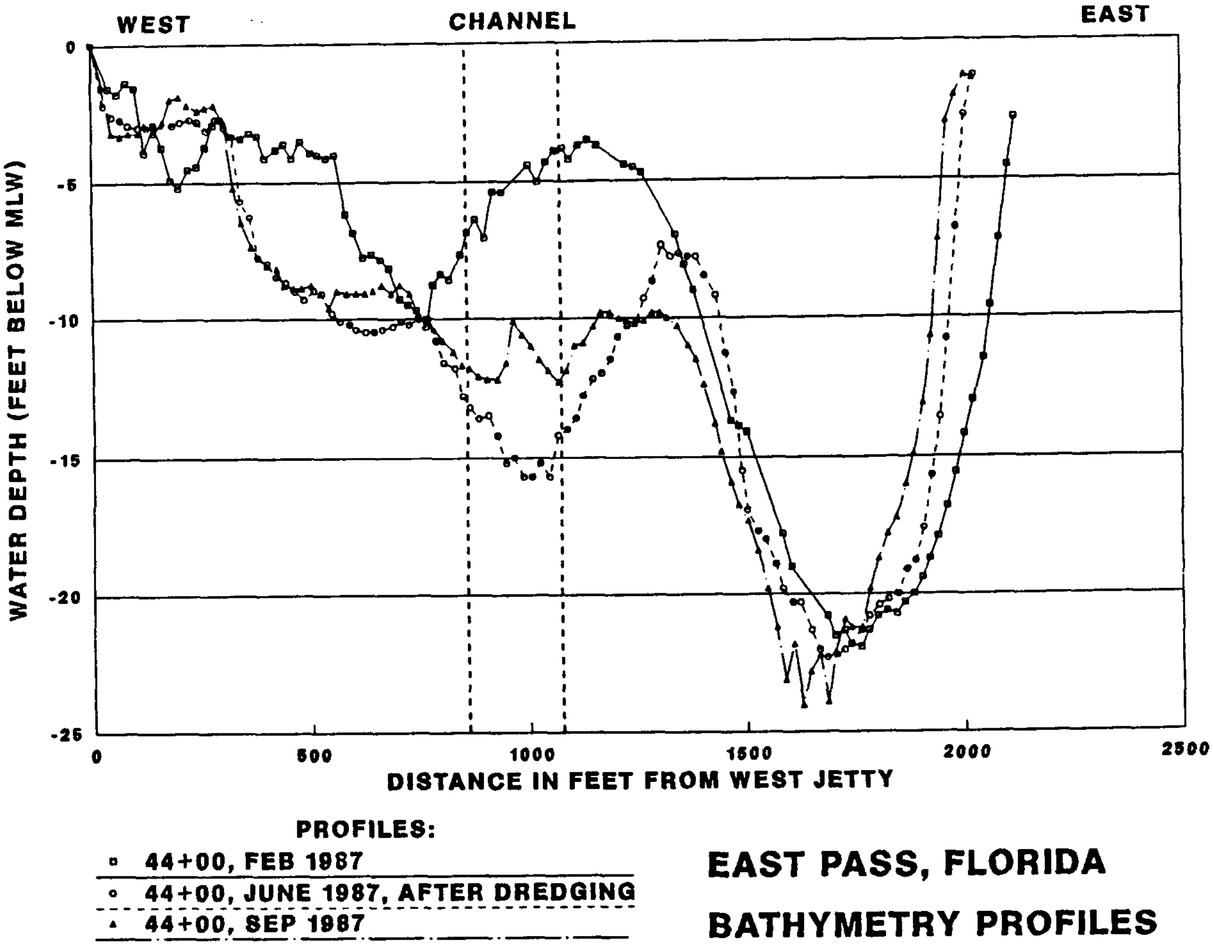

Figure 4. Profiles along line 44+00

ebb-tidal shoal. Here, the thalweg meanders and is subject to rapid changes caused by storms. The navigation channel follows the general route of the thalweg but must be maintained as a straight line from the Gulf of Mexico to the mouth of the inlet. It would be impractical to try to relocate the channel every time the thalweg moved, especially in winter when storms are more frequent. Fortunately, for most of the channel's route over the shoal, the water depth is greater than 12 ft. Shoaling in some areas will always occur and occasional dredging will be needed.

Another way to reduce dredging at East Pass would be to reduce the depth of the maintained channel. The cumulative dredging curve shows that the 6 ft channel needed less than 20 percent of the annual dredging that the 12 ft channel did. A decision to change the dimensions of the navigation channel would require a thorough survey of the types of vessels using the inlet and an analysis of the economic impacts such a change might produce. Even a decrease of only 2 ft to a 10 ft-deep channel might significantly reduce the required maintenance.

Conclusion:

Bathymetric data and historical dredging records from a tidal inlet can be used to analyze physical conditions at the site and provide guidance on whether maintenance dredging can be reduced. Bathymetric profiles across the inlet can show if the navigation channel is in a location that is subject to shoaling and whether it could be realigned to follow the natural thalweg. Historic dredging data may verify that a shallower navigation channel requires much less maintenance. At East Pass, Florida, a combination of the two might contribute to a significant savings in annual maintenance costs.

Additional information:

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